

Section 3: Measure Phase, Box 2-3



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Learning Objectives

- At the end of this section you will be able to:
 - Complete Box 2: Current State
 - Complete Box 3: Target State
 - List the major DMAIC activities in Measure
 - Map the Process
 - Collect Data
 - Narrow Focus
 - Prepare Gate Review
 - Explain the critical role played by the Measure Phase in the DMAIC process

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Box 2: Current State

- What is the Current Process?
- What are the Baseline Metrics?



Lean Six Sigma Pocket: Ch 3 pg 36



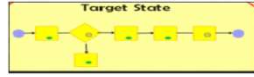
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Box 3: Target State

- What outcomes or AIM/Objectives are expected?
- What changes in metrics can be expected?

Assessment Questions:

- Is there a clear goal or target?
- Specifically, what is to be accomplished?
- How will this goal be measured or evaluated?
- What will improve, by how much, and when?



1	4	7
2	5	8
3	6	9



Lean Six Sigma Pocket: Ch 3 pg 36

Process or Flow Maps



- **Detailed** flow diagrams of the process
- Purpose – to represent the current state as it is now
- Complete the map by walking (GEMBA walk) & discussing the process with the team
- Capture all the complexity & opportunities for improvement



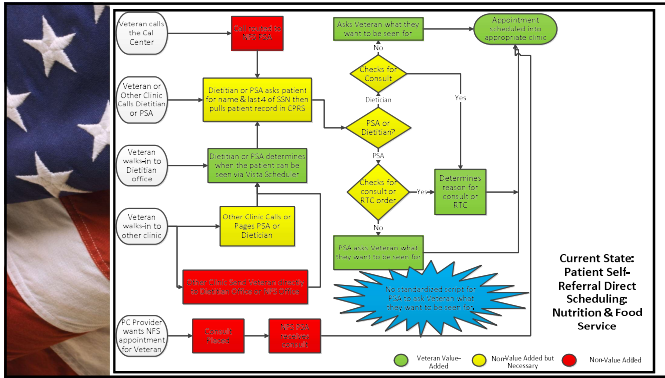
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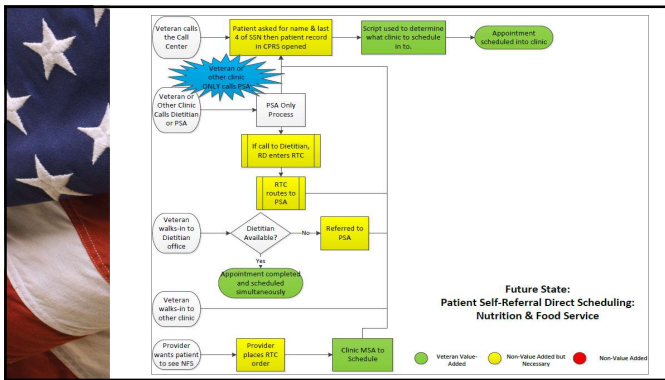
Walk the process “GEMBA”

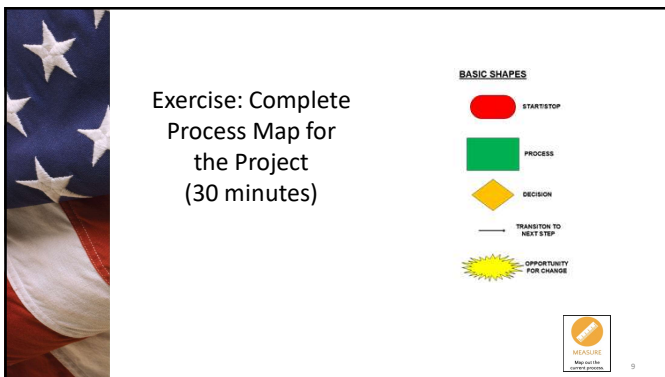
- Observe the process in real time.
- Inform staff ahead of time & let them know what you are doing
- Explain the purpose of the exercise
- Ask staff to go about their business as usual
- Respect privacy
 - Reassure staff that data collection is anonymous
 - Avoid taking pictures of people – just the process



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Value Stream Maps

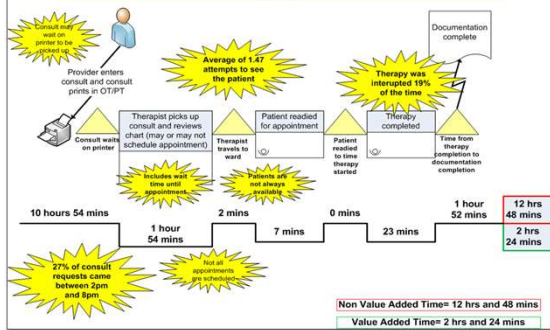
- A visual representation of material, work, & information flow as well as queue times between processes for a specific customer demand
- The map should represent all the main activities relative to the most downstream process
- Two types of Value Stream Maps:
 - Current State**
 - Future State**: Should identify where Lean tools have been applied to the current state map to serve as a visual road map on the waste eliminated

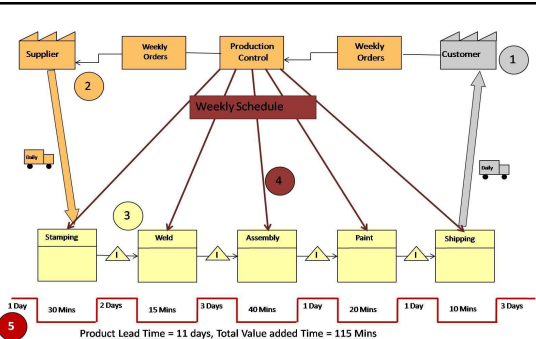


Lean Six Sigma Pocket: Ch 3 pg 45

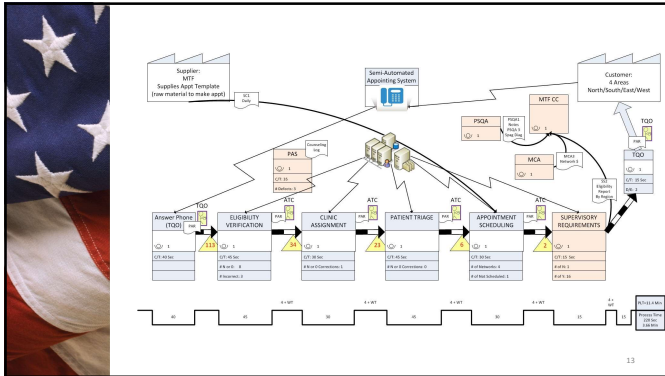
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VALUE STREAM MAP FOR BEDSIDE EVALUATION OF OT/PT PATIENTS (N=36)





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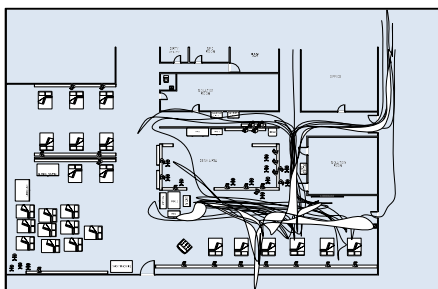
Spaghetti Diagrams

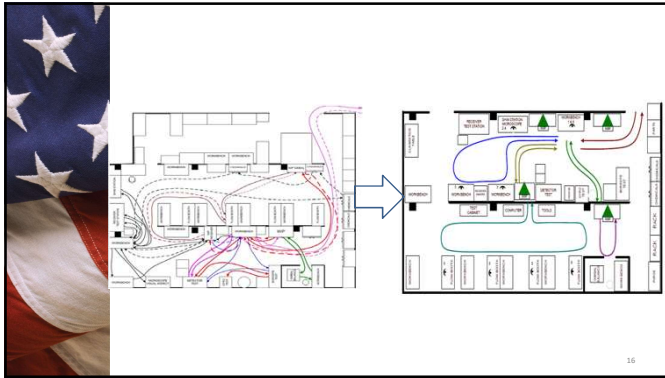
- Shows the flow of some entity, such as a person, a product or a piece of information, as it goes through a process.
- It can be utilized to map the steps taken by employees as they move a product or service from one area to another.
- The name comes from the resemblance to a bowl of cooked spaghetti

Lean Six Sigma Pocket: Ch 3 pg 42



Spaghetti Diagram Example





Measure Phase

- The Measure Phase can be difficult, as data take time to collect & often the team wants to move onto the Improve Phase
- Examples of Measures:
 - Dollars (profit, revenue, cost savings)
 - Weight (ounces in a package)
 - Counts of group characteristics (# of men, types of customers, # of diabetics)
 - Defect counts (customer complaints, errors in a charting template)

Lean Six Sigma Pocket: Ch 1/Ch 5

Why Measure?

- To get a baseline performance before making improvements
 - To help decide if a problem is worthy of further investigation
 - To quantify how much improvement has been made at the end of the project
- To identify cause & effect relationships among inputs & outputs
 - To sort, rank, & prioritize inputs for investigation
 - To prevent future problems by controlling the process

Good Measures:

- Can be linked to what is important to the customer (CCRs)
- Clearly defined
- Valid
- Occur frequently enough to allow for a good sample size
- Representative & relevant to the process
- Reveal trends
- Easy to collect
- Repeatable & Reproducible



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Cost of Poor Quality

- The costs of processes or systems when operating poorly, with waste, or defects
 - **External Failure:** Costs associated with failure after the customer receives the product or service
 - **Internal Failure:** Costs associated with failure before the customer receives the product or service
 - **Appraisal:** Costs associated with inspecting & evaluating the quality of supplies or final product or service
 - **Preventative:** costs incurred to eliminate or minimize appraisal or failure costs
- Striving for CI can improve quality & the organization's financial situation



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Lean Six Sigma Pocket: Ch 4 pg 67

Cost of Poor Quality (COPQ) the Tip of the Iceberg



Choosing the Right Measures

- Metrics help us value projects relative to each other, give context for understanding the impact of the problem, & provide a “scorecard” to measure success
- LSS project metrics fall into 2 categories:
 - **Process Metrics:** Measure the performance of the process as directly experienced by the customer & the business
 - **Business Metrics:** Measure the value of the project to the organization, should the process performance improve to the desired level (usually measured in dollars).



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Process Metrics Include:

- **Quality:**
 - Yield, on-time delivery, % rework
- **Cost or Process Efficiency:**
 - Labor hours per invoice, cost per delivery, units produced per employee, units produced per hour
- **Speed:**
 - Cycle time
- *Environmental, Health, & Safety
- *Regulatory Compliance



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Business Metrics Include:

- Revenue Improvement
- Cost Reduction
- Asset Reduction (inventory)

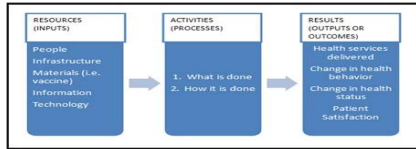


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Three Types of Process Measures

- Key Process Input Variables (KPIV's) X's
- Conversion Process Metrics X's
- Key Process Output Variables (KPOV's) Y's

KPIV's (X's) Process Metrics (X's) KPOV's (Y's)



Lean Six Sigma Pocket: Ch 8 pg 173



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Metrics

- Each metric/KPOV should be linked to the aim of the project
- They should be directly linked to the output of the process
- Must capture the baseline performance for each measure
- Define the goal for each measure (target)
- Should be linked to each KPOV established in the problem statement as being most important to our customers and business (CCR's and CBR's)
 - Quality, Cost, Speed, Environmental Health & Safety, Regulatory Compliance



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Output Measures (KPOV's)

- Improvement teams don't perform well when trying to improve many variables at once
 - A project will target one, or possibly two, KPOV's for improvement
 - Project improvements will focus on "moving the needle" for this measurement
- As the project progresses through DMAIC phases, focus will shift to predictive measure, process metrics, and KPIV's



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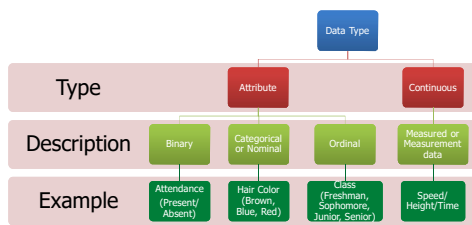
Metric Examples:

- **Patient appointments not linked to consults (KPOV)** will increase from 40% in August to 80% by February
- **Patient wait times (KPOV)** in Orthopedic clinic will decrease from 45 minutes to 10 minutes within 6 months
- Reduce Non Mission Capable rate from Aug 2017 15.2% by 2% by July 2018, 2% by Sept 2018 and achieve <10% by Feb 2019



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Types of Data



Lean Six Sigma Pocket: Ch 5 pg 70

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Data Types - Continuous

- Can be divided infinitely
 - 3.14, 3.141, 3.14159265...
- Usually measured on a “device”
 - Odometer, ruler, micrometer
- Pro:
 - Need fewer observations to draw conclusions
 - Can be converted to attribute data easily
- Con:
 - May not be readily available (especially for transactional projects)
- Examples: Height, time, temperature



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Data Types – Discrete/Attribute

- Count
 - Example: Number of errors
- Binary Data: Data that can only have 1 or 2 values
 - Example: Yes/No; Pass/Fail
- Attribute-Nominal Data: Names or Labels
 - Example: Dept. A, Dept. B, Dept. C
- Attribute-Ordinal Data: Names or labels represent some value to the object showing order to the labels
 - Example: Likert scale; Salsa taste; grade level



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Measurement System Analysis

- Validates the collected data & how it is being collected
- Completed prior to:
 - Drawing conclusions from the data
 - Implementing solutions
 - Running experiments
 - Performing statistical analysis

Measurement Systems Analysis		
Measurement System Area	Key Questions	Observations for this Project
Resolution	Are you measuring to a fine enough degree in order to see process variation?	
Bias	Are there any differences (typically consistent) between the observed measured values and the actual values?	
Stability	Is the data consistent from one time period to another, indicating the measurement system has not changed?	
Repeatability	Can the same person get the same results when collecting the same data?	
Reproducibility	Can different people get the same results when collecting the same data?	
Unit-to-unit Variation	This all we want to avoid. By understanding variability in all areas above we expect to see only unit-to-unit variation. Is there any reason to believe that we are seeing anything but unit-to-unit variation in our data?	



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Lean Six Sigma Pocket: Ch 5 pg 87

Process Capability

- What is it? Can the process meet the customer requirements?
 - The ability of the process to meet the customer requirements without additional intervention*
 - *Extraordinary or additional steps outside of normal operations, including rework/repairs performed downstream
 - Tells us how process centering & variation match the specifications to satisfy the customer
 - Can be used to evaluate either continuous or attribute data
 - Can be applied to a single process step or an overall process with multiple steps



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Capability – Sigma Quality Level (SQL)

- SQL = a common measure of process performance with respect to customer requirements.
- Processes should generally have a SQL of at least 4.0 to be considered "Capable"

σ	DPMO*	Yield
6	3.4	99.9997%
5	233	99.977%
4	6,210	99.379%
3	66,807	93.32%
2	308,537	69.2%
1	690,000	31%

* Defects Per Million Opportunities



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Exercise: Defining Measures & Goals (15 minutes)

1. Within your groups, define 1 – 2 critical project KPOV's & corresponding goals
 2. Be prepared to discuss with larger group
- What will be the Primary Measures to assess progress & success?
 - What is the goal for each measure?
 - How much improvement is needed, by when (provide target dates)?



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Operational Definitions to Collect Data

- You want to be specific in how you measure your data to make it valid
 - You need a precise definition that tells us how to get data values for characteristics or variables that are trying to be measured
 - Standardized data collection
- Example: You are ordering 10 pizzas for a party and you would like them delivered "on time." You are serving your guests at 7pm. Is early delivery acceptable? How early? How late? Do you need to specify other parameters of the deliver (address, correct order, hot pizzas)?



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Data Collection

- Data Collection Plan:
 - What to measure
 - How to measure it
 - When and where to measure it
 - How many measurements to make
 - A method to assess the variation of the data collection process
- Data sources can be varied (historical, current process, new process, experimentation)

Lean Six Sigma Pocket: Ch 5 pg 69,72

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Template: Plan Data Collection

Data Collection Plan

Measure	Type of Measure	Operational Definition	Data Source & Location	How will data be collected?	Who will collect data?	When will data be collected by?	Sample Size	Stratification Factors (X Data)	How will data be used & Displayed?



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Measure	Type of Measure	Operational Definition	Data Source & Location	How will data be collected?	Who will collect data?	When will data be collected by?	Sample Size	Stratification Factors (X Data)	How will data be used and displayed?
Number of Compliance emails sent per month.	Output Metric	CPRS Note documentation needs to state who the Attending is and concurrence with the plan.	Compliance Email spreadsheet. Located on S:Drive:Resident Compliance: Documentation tracking	Manually: Reviewed for Resident Supervision each month electronically.	Me	15 th of each month.	1-8 notes	Orthopedics	Reviewed for how many emails, how many responses received and how many did not and attach a \$5 amount to each.

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Data Collection Tools

Do we need another example

- Check Sheets

Reason	Day					Total
	Mon	Tues	Wed	Thurs	Fri	
Wrong number	487	1	1	487	487	20
Left message	11	1	1	1	1	15
Busy	487	1	487	1	11	10
Total	12	5	12	8	13	40

- Automated data collection – CPRS chart reviews, VSSC, SAIL
- Sampling
- Surveys – Press Ganey or talking with employees and Veterans



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Sampling:

- Samples are great in that they are efficient. The down side to samples is that they vary.
- Factors to consider when determining Sample Size:
 - Situation
 - Data type
 - Objectives
 - Familiarity
 - Certainty
- Best way to choose a sample:
 - Random
 - Systematic
- If a sample of 15 out of a population of 5,000 are taken and another sample of 15 out of the same population is taken, we are not likely to get the same answer.
- The larger the sample size, the better the sample will represent the population. However, amount of time available needs to be considered.

Lean Six Sigma Pocket: Ch 5 pg 81



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Selecting the Right Sampling Choices

- What are the sources of variation we are concerned about?
 - Measurement variation
 - Within hour variation
 - Hour to hour
 - Morning to afternoon to evening
 - Day to day
 - Week to week
 - Month to month



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Determine if any Quick Wins

- Improvements before the Improve Phase
- Sometimes the work done in the Define and Measure phases highlight key opportunities for quick improvements
- The team does not have to wait until the project is in the Improve phase to address these opportunities if they are quick wins
- 2 Types:
 - Just-Do-Its
 - Kaizen Events/Rapid Process Improvement Workshops (RPIW)



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Just-Do-Its

- Criteria:
 - Readily apparent solution, only improve and control
 - The solution can be implemented within a few weeks
 - Low cost to implement
 - No additional buy-in or approvals needed outside the team
 - Low risk to customers, process performers, or other stakeholders
 - Easily reversible




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Kaizen or RPIW


- Solution unknown, follows full DMAIC process
- Kaizen/RPIW event in full-time teamwork for one week to speed up the improvement process
- Involves 3-5 weeks part-time for preparation before the event week (Define & Measure, boxes 1 – 3)
- One week full-time (Analyze & Improve, boxes 4 – 6)
- Involves 3 – 6 weeks part-time for transition (Control phase, boxes 7 – 9)
- Initial results typically in 4 – 6 weeks compared to a full DMAIC, which is part-time for 6 – 12 months





Measure Gate Review

- Deliverables:
 - Updated project charter, including financial benefits
 - Detailed process map and/or value stream map
 - Data collection plan
 - Baseline data
 - Completed tollgate



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